2005

Evaluation of clinical indicators and social context for developing lifestyle modification programs after gestational diabetes mellitus: a case study of a cohort of women in the Illawarra region, Australia

Janelle Barnard

University of Wollongong

EVALUATION OF CLINICAL INDICATORS AND SOCIAL CONTEXT FOR DEVELOPING LIFESTYLE MODIFICATION PROGRAMS AFTER GESTATIONAL DIABETES MELLITUS:

A CASE STUDY OF A COHORT OF WOMEN IN THE ILLAWARRA REGION, AUSTRALIA

A thesis submitted in fulfilment of the requirements for the award of the degree

DOCTOR OF PHILOSOPHY

from

UNIVERSITY OF WOLLONGONG

by

JANELLE BARNARD, BBUS *CSU*, BSC *UOW,* MSC *UOW*

SMART FOODS CENTRE
AND
DEPARTMENT OF BIOMEDICAL SCIENCES
University of Wollongong

2005

CERTIFICATION

I, Janelle A. Barnard, declare that this thesis, submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy, in the Department of Biomedical Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Janelle A. Barnard

25th February 2005

DEDICATION

This work is dedicated to the glory of God.

He renews my strength.
He guides me along right paths
bringing honour to his name.
Psalm 23:3

It is with your grace that I find myself in this place. It has ultimately been to you that I have turned when I have been disheartened and confused and you have blessed me with a way forward. Your strength has held me up. You have used me as your instrument to serve you, and reminded me to serve my brothers and sisters with love, honesty and respect. I humbly thank you.

Don't worry about anything; instead pray about everything. Tell God what you need and thank him for all he has done. If you do this, you will experience God's peace, which is far more wonderful than the human mind can understand. His peace will guard your hearts and minds as you live in Jesus Christ.
Philippians 4:6-7

God bless and peace be with you.

ACKNOWLEDGEMENTS

To my husband, Peter, and daughters Hannah and Paris: we have all travelled this winding path together and I thank you for your perseverance and helping me to learn all about being wife, mum and having both the love and the responsibility of a family. Pete, you deserve special thanks for supporting me physically and emotionally and putting up with this for too many years! Our beautiful girls have been patient with my need and desire to carry out this project to completion, and the stress that has gone with it. They are all such a lovely blessing.

My friends within and outside the university environment have been invaluable. Vanessa Brenninger, Michelle Gordon, Susie Gane, Liesl McCoy, Helen Ient, Nicola Don, Nicole Smede, Lynda Gillen, and Leisa Ridges have been there through thick and thin spiritually, emotionally, and professionally.

My primary supervisor Professor Linda Tapsell has provided fantastic guidance and support and brought to the table not only her professional wisdom, but the wisdom of a mother and wife. That amazing capacity to do it all and make time to share her experience is admired and valued. Her decisiveness and ability to stand back or to put pressure on where needed has been greatly appreciated. Associate Professor Arthur Jenkins has also been especially helpful with the technical aspects of the thesis and in doing what does not come naturally to him – letting the project evolve and move away from the lab. Thank you to you both. Special mention must also go to Professor Len Storlien who assisted in supervision initially, before he left us for Sweden. Even in a busy schedule he allowed time for me ("time is infinitely expandable").

Thanks to Dr Bob Moses who provided initial advice and the opportunity to begin this work at the Illawarra Diabetes Service. Lab technicians, clinical professionals, and colleagues at the University of Wollongong and at Royal Price Alfred Hospital

(RPAH) are to be acknowledged for their technical assistance. Among them are Liz Gregoris-Deane, Dr Alice Owen, Dr Barbara Meyer, Dr Greg Peoples, Dr Adam Fraser, Sr Sheena McGhee, Dr Janine Higgins, Associate Professor Ken Russell, Margaret Brown, Jane Thomson, Mandy Theiss, Marion Baré, Alex Sharp (RPAH), Kris Tan (RPAH), and IT specialists Angus Beath and Melissa Detriech. Nicole Smede, Stuart Parker, Nola Hurt, Marion Harvey, Melissa Errey and others in the Department of Biomedical Sciences and Smart Foods Centre have assisted in many important ways and I have appreciated it every time. A special thank you to Dr Tania Markovic, Endocrinologist at RPAH for taking time out from a busy schedule to provide advice on indices of Polycystic Ovary Syndrome. Others who have provided much appreciated assistance include Dr Evie Leslie, Dr Melinda Irwin and Dr Barbara Ainsworth.

Without funding support, these types of research projects would not take place. Thanks to the Smart Foods Centre, Metabolic Research Centre and Office of Research at the University of Wollongong for assisting with funds during this thesis. Small grants/awards from the Council of Australian Postgraduate Association and Nutricia have provided much needed and valued assistance.

To capture the complexity of family life and add to scientific debate on clinical intervention is a difficult but important task. It is my intention that this work will help to describe, understand and support women with previous gestational diabetes to be able to access programs that will allow them to enjoy greater health with their families. I thank all of those women and their support people who shared their time, bodies and experiences with me to assist in achieving this aim. It is my sincere wish that they are happy with this work and the way this snapshot of their lives has been presented.

PUBLICATIONS

Peer reviewed publications in support of this thesis

Barnard, JA, Tapsell, LC, Davies, PSW, Brenninger, VL, Storlien, LH (2002), Relationship of high energy expenditure and variation in dietary intake with reporting accuracy on 7 day food records and diet histories in a group of healthy adult volunteers. *European Journal of Clinical Nutrition,* 56, 358-67.

Presentations in support of this thesis

Barnard, JA, Tapsell, LC, Jenkins, AB (2003), Comparison of three methods of assessing physical activity and energy expenditure in a sample of Australian women with previous gestational diabetes mellitus. Poster presentation at *The International XVII Puijo Symposium: "Physical Activity and Health: Gender Differences Across the Lifespan", Kuopio, Finland, June 2003.*

Barnard, JA, Tapsell, LC (2003), Women with previous gestational diabetes mellitus may need to reduce saturated fat intake and spend more time in activity outside the house. Oral presentation and conference proceedings. *Diabetes and Nutrition Study Group of the European Association for the Study of Diabetes 21st International Symposium on Diabetes and Nutrition, Brugge, Belgium, June 2003.*

Barnard, JA, LC Tapsell, LC, (2003), Early signs of the metabolic syndrome in a sample of Illawarra women with recent gestational diabetes mellitus. Oral Presentation and proceedings. *Illawarra Area Health Medical Research Week Symposium, Wollongong, 2003.*

Barnard, JA, Tapsell, LC, Jenkins, AB, Moses, RG (2003), Postpartum glucose tolerance and self-reported habitual diet of a sample of women with previous gestational diabetes mellitus: evidence for intervention. Oral presentation and

conference proceedings. *DAA 21st National Conference, 'Evolution, Evidence, Enterprise', Cairns, May 2003*.

Barnard, JA, Tapsell, LC, Jenkins, AB, Moses, RG (2003), The quest for best evidence in clinical studies: some preliminary observations. Poster presentation and conference proceedings. *DAA 21st National Conference, 'Evolution, Evidence, Enterprise', Cairns, May 2003*.

Barnard, JA, Tapsell, LC (2001) Validation of a physical activity questionnaire as a tool for assessing energy expenditure. Poster presentation. *2001 Australian Conference of Science and Medicine in Sport, Perth, October 2001.*

Barnard, JA, Tapsell, LC, Jenkins, AB, Moses, RG (2001), Reported diet and physical activity habits of a sample of women with previous gestational diabetes mellitus in the Illawarra region of NSW. Poster presentation. *DAA 20th National Conference, 'Nutrition and Dietetic Practice: Reflections and New Horizons', Adelaide, May 2001*.

Barnard, JA, Tapsell, LC, Brenninger, VL, Higgins, J, Jenkins, AB, Davies, PSW and Storlien, LH (1999), Accurate reporting of diet and physical activity: identifying "ideal" subjects for dietary intervention trials**.** Oral presentation and proceedings publication. *2nd South-West Pacific Nutrition and Dietetic Conference, Auckland, September 1999.*

Other peer reviewed publications

Tapsell, LC, Brenninger, VL, **Barnard, JA** (2000), Applying conversation analysis to support accurate reporting in the diet history interview. *Journal of the American Dietetic Association* 100, 818-24.

Other presentations

Tapsell, LC, Gillen, LJ, **Barnard, JA**, Jenkins, AB, Moses, RG (2002) Optimising dietary fat to prevent obesity? A dietetic approach in the context of gestational diabetes mellitus. Poster presentation. *Australian Health and Medical Research Congress, Melbourne, November 2002.*

Gordon MA, **Barnard JA**, Tapsell LC, Jenkins AB, Grenyer B (2001), Comparison of physiological and appetite related variables in non-obese women classified as restrained and non-restrained eaters. Oral presentation. *10th ASSO Scientific Meeting, Gold Coast, September 2001.*

Brenninger, VL, Tapsell, LC, **Barnard, JA** (2001), Assessing energy intake: qualitative and quantitative methods account for variations*. 33rd Annual Public Health Association of Australia Conference 2001, "A Public Health Odyssey: Popular Culture, Science & Politics", Sydney, September 2001.*

Brenninger, VL, Tapsell, LC, Jenkins, AB, **Barnard, JA** (2001), Food sources of starch: implications for an intervention study involving resistant starch. Poster presentation. *DAA 20th National Conference, 'Nutrition and Dietetic Practice: Reflections and New Horizons', Adelaide, May 2001*.

Brenninger VL, Tapsell, LC, **Barnard, JA**. (1999), Assessing usual dietary intakes: straightforward vs problematic reporting. Oral presentation and proceedings publication. *2nd South-West Pacific Nutrition and Dietetic Conference*, Auckland, *September 1999*.

Tapsell, LC, **Barnard, J**, Brenninger, V, Higgins, J, Jenkins, AB, Davies, PSW and Storlien LH (1999), Dietary reporting in 'free-living' individuals: implications for intervention trials. Poster presentation. *Diet and the Metabolic Syndrome. The Swedish Nutrition Foundation 21st International Symposium, Ystad, August 1999.*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

7dFR	seven day food record
%BF	percentage body fat
%CV	coefficient of variation
AD	activity diary
BIA	bioelectrical impedance analysis
BMI	body mass index
BMR	basal metabolic rate
CVD	cardiovascular disease
DH	diet history
DHEA-S	dehydroepiandrosterone-sulphate
DLW	doubly labelled water
EE	energy expenditure
EE_{meas}	energy expenditure directly measured by doubly labelled water
EE_{pub}	energy expenditure indicated by published doubly labelled water
EE_{Q}	energy expenditure estimated by questionnaire
EI	energy intake
EI_{DH}	energy intake measured by diet history
EI_{rep}	reported energy intake
FAI	free androgen index
FFQ	food frequency questionnaire
FR	food record/s
FSH	follicle-stimulating hormone
GDM	gestational Diabetes Mellitus
HDL-C	HDL cholesterol
HOMA	Homeostatic Model Assessment
HOMA-%B	ß-cell function assessed by Homeostatic Model Assessment
HOMA-%S	insulin sensitivity assessed by Homeostatic Model Assessment
HOMA-IR	insulin resistance assessed by Homeostatic Model Assessment
IFG	impaired fasting glucose

IGT	impaired glucose tolerance
LDL-C	LDL cholesterol
LH	luteinising hormone
LHQ	Lifestyle History Questionnaire
MAQ	Modifiable Activity Questionnaire
MET	metabolic equivalent
MUFA	monounsaturated fatty acids
n-3	omega-3 fat/fatty acids
n-6	omega-6 fat/fatty acids
OGTT	oral glucose tolerance test
PAL	physical activity level
PCOS	polycystic ovary syndrome
P:S	polyunsaturated to saturated fatty acid ratio
PUFA	polyunsaturated fatty acids
SFA	saturated fatty acids
SHBG	sex hormone binding globulin
T1DM	type 1 diabetes mellitus
T2DM	type 2 diabetes mellitus
TC	total cholesterol
TEE	total energy expenditure
TEF	thermic effect of food
VLCn3	very long chain omega-3 fatty acids
WHO	World Health Organisation

ABSTRACT

Women with previous gestational diabetes mellitus (GDM) have a 30-50% future risk of developing Type 2 diabetes mellitus (T2DM), a global public health problem. Preventive approaches would target diet and physical activity behaviours yet little is known about these lifestyle parameters in this group. This thesis describes the diet, physical activity and risk factor profile of a sample of women with previous GDM from the Illawarra region of New South Wales, Australia. A comprehensive ethnographic description is created profiling the sample using both quantitative (surveys, diet and physical activity measurements and clinical assessments) and qualitative techniques (in depth interviews). The central hypothesis is that, while the need for diet and physical intervention may be clearly demonstrated in this group of women, the complexities of their lives needs to be considered when developing how these interventions might be delivered.

It is reasonable to assume that providing interventions for women with small children may pose practical and social challenges that warrant consideration in program design.The main aim of the research was therefore to assess the extent of the need for intervention for an identifiable cohort of women and qualify this with and an in-depth analysis of these practical and social issues. Subjects were recruited from the database of women referred to the Illawarra Diabetes Service who would be 10-25 months post-partum at the time of the study. Of a potential 150 subjects, 52 were accessible and completed a telephone interview, 19 completed a more in-depth cross-sectional survey, and 21 completed in-depth interviews with a further ten “support” people recruited through a snowballing technique. The health profile of the subjects confirmed the need for diet and activity intervention. Ten of 18 women completing a standard glucose tolerance test produced an abnormal result and were advised to seek further medical care. Dietary intake patterns were not in keeping with current recommendations for the prevention of T2DM (total fat 34.9±7.7%, SFA 13.2±4.0%, PUFA 5.5±1.7% compared to targets of <30%, <10% and >10% respectively). While 16 of 19

women met physical activity guidelines, the research indicated that further work on the nature of physical activity in this group warrants consideration and that current, more general physical activity guidelines for the prevention of T2DM be adapted for this group. Most of the women (47 out of 51) initially expressed an interest in lifestyle programs but indicated that time and childcare barriers would prevail. In-depth interviews indicated that there were differences between women in relation to the potential accessibility of lifestyle intervention programs and that this may rest on feelings of empowerment within the limited capacity of family systems. Opportunities for lifestyle intervention in healthcare services are likely to lie within a model of family-centred therapy. This acknowledges that the lives of these women are embedded in an interdependent network of individuals forming the family system.